[0029] In particularly preferred examples of the JFETs hereinbefore described with reference to **FIGS. 2 and 3**, the underlying substrate is stepped to facilitate self assembly of the fullerene layers. The preferred embodiments of the present invention hereinbefore described with reference to **FIGS. 2 and 3**, a silicon substrate was employed. However, in other embodiments of the present invention, a different substrate material may be employed, such as silicon dioxide for example.

[0030] Referring now to **FIG. 4**, yet another JFET embodying the present invention comprises a single undoped fullerene **30** adjacent a single doped fullerene **31**. The doped fullerene **31** is doped with an n-type dopant. In operation, the undoped fullerene **30** forms the conduction channel of the JFET extending between source S and drain D, and the doped fullerene **31** forms the gate region G of the JFET. Turning to **FIG. 5**, another diode embodying the present invention comprises a single undoped fullerene **40** adjacent a single doped fullerene **41**. The doped fullerene **41** is doped with an n-type dopant. In operation, the undoped fullerene **40** is connected to the anode of the diode and the doped fullerene is connected to the cathode. In both the **FIG. 4** JFET and **FIG. 5** diode, the undoped fullerene **30** is C60 and the doped fullerene is Li@C60. However, it will be appreciated that different fullerenes and dopants may be employed.

[0031] In the embodiments of the present invention hereinbefore described, junctions are formed between metal-doped and undoped fullerenes. However, in other embodiments of the present invention, both similar and different devices may be produced by forming junctions between metal-doped fullerenes in which the dopants and/or doping concentrations differ. Accordingly, embodiments of the present invention include device structures involving $n\text{-}n^+$, $p\text{-}p^+$, and many other junctions. By combining p-type and n-type doped fullerene layers, n-p-n and p-n-p bipolar transistor structures with nanometer dimensions can be produced. Similarly, quantum well heterostructures can be made by stacking appropriately doped fullerene layers.

EXAMPLES

[0032] Examples of test junctions and their corresponding I/V characteristics will now be described with reference to FIGS. **6** to **10**. These junctions are intended to be examples only and not to limit the invention as claimed in any way.

[0033] Referring first to **FIG. 6, a** first test junction was produced by depositing an undoped fullerene layer **2** on a metal substrate. The metal substrate **1** was formed from gold, Au(110), and the undoped fullerene layer **2** was a two molecule thick layer of C60. With reference to **FIG. 7**, I/V spectroscopy testing of the junction with a scanning tunneling microscope revealed an I/V characteristic typically associated with a semiconductor. Specifically, the observed I/V characteristic exhibited tunneling breakdown in both reverse biased and forward biased directions and substantially zero gradient through the origin.

[0034] Referring now to **FIG. 8, a** second test junction was produced by depositing a doped fullerene layer **3** on a metal substrate **1**. The metal substrate **1** was again formed from Au(110) and the doped fullerene layer **3** was a 1 molecule thick (0.7 nm) layer of Li@C60. With reference to **FIG. 9**, I/V spectroscopy testing of the junction with a scanning tunneling microscope revealed an I/V characteristic typically associated with an ohmic conductor such as a metal. Specifically, the observed I/V characteristic exhibited a non zero and substantially linear gradient through the origin.

[0035] With reference again to **FIG. 1, a** third test junction was produced by depositing an undoped fullerene layer **2** and a doped fullerene layer **3** on a metal substrate **1**, with the undoped fullerene layer **2** disposed between the metal substrate **1** and the doped fullerene layer **3**. The metal substrate **1** was again formed from Au(110). The undoped fullerene layer **2** was a two molecule thick layer of C60. The doped fullerene layer **3** was a 1 molecule thick layer of Li@C60. With reference to **FIG. 10**, I/V spectroscopy testing of the junction with a scanning tunneling microscope revealed an I/V characteristic typically associated with a Schottky diode. Specifically, the observed I/V characteristic exhibited thermionic emission in the forward biased direction, tunneling breakdown in the reverse biased direction, and a substantially zero gradient through the origin.

1. An electronic device comprising a junction formed between a first fullerene layer having a first doping concentration and a second fullerene layer having a second doping concentration different from the first doping concentration.

2. A device as claimed in claim 1, wherein the first doping concentration is zero.

3. A device as claimed in claim 1, wherein the second fullerene layer is a monolayer.

4. A device as claimed in claim 1, wherein the first fullerene layer is a monolayer.

5. A device as claimed in claim 1, wherein the second fullerene layer comprises an electron donor dopant.

6. A device as claimed in claim 1, wherein the second fullerene layer comprises an alkali metal or lanthanum dopant.

7. A device as claimed in claim 6, wherein the second doping concentration is in the region of 10^{21} per cm^3.

8. A device as claimed in claim 7 in the form of a diode wherein the first fullerene layer is connected to an anode and the second fullerene layer is connected to a cathode.

9. A device as claimed in claim 1 in the form of a field effect transistor wherein the first fullerene layer serves as a gate region and the second fullerene layer serves as a channel region extending between a source terminal and a drain terminal.

10. A device as claimed in claim 1, wherein the second fullerene layer comprises an electron acceptor dopant.

11. A device as claimed in claim 1, wherein at least one of the first and second fullerene layers is formed from C60 or C82.

12. A device as claimed in claim 1, wherein at least one of the first and second fullerene layers consists of a single bucky ball.

13. An electronic device comprising a junction formed between a first fullerene layer having a first doping concentration and a second fullerene layer having a second doping concentration different from the first doping concentration, wherein at least one of the first and second fullerene layers is a monolayer.

14. The device as claimed in claim 13, wherein the second fullerene layer comprises an electron donor dopant having a concentration of about 10^{21} per cm^3.